

QUARTERLY REVIEW

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Geologic Investigation in the State of Utah

May, 1965

SO. UTAH'S RARE METALS

There are significant deposits of titanium, zirconium, thorium, and other rare metals in ancient beach sands of Cretaceous age in south-central and southern Utah. According to U. S. Bureau of Mines R.I. 5860, by V. T. Dow and J. V. Batty, sixteen deposits are known in the region. It is estimated that there are over 1,043,000 tons of material with an average of 17.98% titanium oxide, 5.67% zirconium oxide, and 0.09% thorium oxide.

Beneficiation tests conducted by the Bureau of Mines indicate that the material can be concentrated and separated into titanium and zirconium products meeting market specifications. The sands are radioactive and dark-colored, and contain the heavy mineral ilmenite, anatase, leucosene, magnetite, zircon, monazite, garnet, and tourmaline, cemented with hematite and calcium carbonate.

The deposits investigated are in the Emery, Henry Mountains, Escalante, and Kaiparowits Plateau areas of Emery, Garfield, and Kane Counties. The maximum concentration of titanium oxide reported is 25.3%, whereas the maximum of zirconium oxide is 18.1%. The maximum concentration of thorium ox-

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DONATIONS ANYONE?

April 22nd the Utah Geological Survey received from the Brush Beryllium Company a special gift—the components of a pilot plant flotation mill. This mill had previously been used for beryllium extractive investigations, and the Survey plans to proceed with other extractive studies of benefit to the mineral industry in the State of Utah. One major drawback remains—the Survey has no place to house the equipment. Temporarily stored beneath the balcony of a World War

II barrack (see photograph), the mill requires an 1800-square-foot concrete pad and accompanying building to house it. If there be an individual or a corporation that has an unused Quonset Hut, or the where-with-all for the concrete pad, the Survey would gratefully accept such donations. Further details can be obtained from W. P. Hewitt, Utah Geological Survey Director, 103 Civil Engineering Building, University of Utah.



QUARTERLY REVIEW

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THE LAST QUARTER

The last to be published and most sought after of all the quadrants of the colored geologic maps of Utah, the Southeast Quarter completes the compilation of the finest state geologic map now available. Copies

may be obtained from the Utah Geological and Mineralogical Survey for \$3.50 over-the-counter, or \$4.00 post-paid. Scale 1:250,000. Size 46" x 60".

SUMMER ACTIVITIES

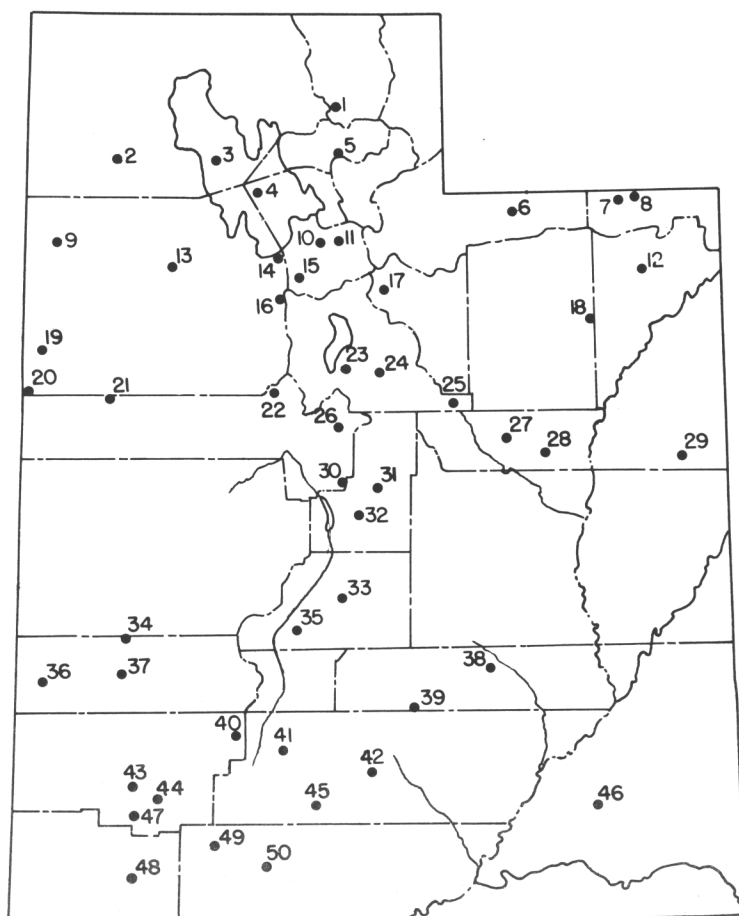
The Utah Geological Survey recently canvassed various universities and governmental agencies for reports of scheduled summer

activities within the State. Although by no means complete, the information obtained from the canvass is plotted on the facing map,

with numerical references listed below. Summer projects of the Utah Geological Survey are indicated by an asterisk (*).

Ref. No.	Investigator	School - Agency	Purpose	Subject
1	Hardy, C. T.	U.S.U.	FR	Structural Geology of the James Peak Quadrangle, Utah.
2	Steininger, R.	B.Y.U.	M.S.	Petrographic and Economic Study of Newfoundland Stock, Newfoundland Mountains, Utah.
3*	Hahl, D. C.	U.G.M.S.-U.S.G.S.	Water Resource	Chemical Analyses of Great Salt Lake Brine.
4*	Kayser, R. B.	U.G.M.S.-U. of U.	Ph.D.	Hydrologic and Engineering Studies of Great Salt Lake.
5	Crittenden, M. D.	U.S.G.S.	Regional Mapping	Ogden Area, Utah, Structural Studies.
6	Gunn, D. C.	Wash. S.U.	Ph.D.?	Mississippian-Cambrian Unconformity, Uinta Mtns. and Vicinity.
7	Dyni, J. R.	U.S.G.S.	Min. Class.	Quadrangle mapping—Manila area—phosphate, coal, oil shale?, bentonite, and manganese.
8	Jordan, W. M.	U. of Wisc.	Ph.D.	Geology of the Nugget and Navajo Sandstone, Utah and western Wyoming.
9*	Sutton, M. L.	U.G.M.S.	Mineral and Water Resources	Survey of brines of Great Salt Lake Desert.
10	Van Horn, R.	U.S.G.S.	Geology	Geology of Salt Lake City and Vicinity.
11	Chamberlain, C. K.	B.Y.U.	M.S.	Upper Paleozoic Trilobites of Central Utah.
12	Schell, E. M.	U.S.G.S.	Min. Class.	Strip mapping—Permian Park City Formation—phosphate study.
13	Maurer, R. E.	U. of U.	Ph.D.	Geology of the Cedar Mountains, Tooele County, Utah.
14	Lohrengel II, C. F.	B.Y.U.	M.S.	Paleoecology of the Morrowan Age Oquirrh Formation.
15	Roberts, R. J.	U.S.G.S.	Base Metals	Geologic Mapping; Bingham, Lark, Stockton, and Fairfield Quadrangles.
16	Lufkin, J.	B.Y.U.	M.S.	Geology of North Soldier Canyon Area, Tooele Co., Utah.
17	Bromfield, C. S.	U.S.G.S.	Base Metal	Stratigraphy and structure in the Park City district.
18	Black, C. C.	Carnegie Museum	Prospecting and Museum Collecting	Late Eocene Uinta Basin Vertebrates.
19*	Langford, H.	U.G.M.S.-U.S.G.S.	Water Resources	Analyses of mineralized waters of western desert.
20*	Thomson, K. C.	U.G.M.S.-U. of U.	Mineral Resources	Ore deposits and geochemistry Gold Hill area, Utah.
21	Balsley, J. K.	U. of U.	M.S.	Geol. and Ore Dep.—Fish Springs mining district.
22	Morris, H. T.	U.S.G.S.	Base Metal	Stratigraphy and structure in the Sheeprock Mtns., Cherry Creek Quadrangle.
23	Brady, M. J.	B.Y.U.	M.S.	Thrusting in the Southern Wasatch Mountains, Utah.
24	Bordine, B. W.	B.Y.U.	M.S.	Paleoecologic studies, Thistle area, Utah County, Utah.
25	Moussa, M. T.	U. of U.	Ph.D.	Geology of the Soldier Summit Quadrangle, Utah.
26	Black, B. A.	B.Y.U.	M.S.	The Nebo Thrust, Southern Wasatch Mountains, Utah.
27	Howard, J. D.	B.Y.U.	M.S.	Panther Member of the Star Point Formation, Cretaceous.
28	Wiley, D.	U. of U.	M.S.	Petrographic study of bituminous sandstone, Carbon County.
29*	Byrd, W. D. Gwynn, J. W.	U.G.M.S.	Mineral Resources	Appraisal of asphalts of PR Springs.
30	Brown, H. T.	Soil C.S.	Hydrogeology	Markagunt and Gunnison Plateaus area—Sevier River Basin studies.
31	Weiss, M. P.	Ohio S. U.	FR	Flagstaff Formation, central Utah.
32*	Pratt, A. R.	U.G.M.S.	Mineral Resources	Mineral appraisal of Sevier County.
33*	Maurer, R. E.	U.G.M.S.	Mineral Resources	Mineral appraisal of Sevier County.
34	Lemmon, D. M.	U.S.G.S.	Base Metal	Geologic Mapping, San Francisco District.
35	Shroder, J.	U. of U.		Landslides in Utah — Uinta and Wasatch Mtns. and Wasatch Plateau.
36	Conrad, O. G.	U. of Texas	Ph.D.	Volcanic rocks of western Beaver County, Needles Range sequence.

Ref. No.	Investigator	School - Agency	Purpose	Subject
37*	Whelan, J. A.	U.G.M.S.	Mineral Resources	Geology and mineral resources of the Star mining district.
38*	Heylmun, E. B.	U.G.M.S.-U. of U.	Mineral Resources	Stratigraphy and economic geology of the Henry Mtns. Basin, Wayne County, Utah.
39	Marzolf, J. E.	U.C.L.A.	Ph.D.?	Stratigraphic analysis of Navajo Sandstone in southern Utah
40	Anderson, J. J.	U. of Texas	Ph.D.	Geology of northern part of the Markagunt Plateau.
41	Rowley, P. D.	U. of Texas	Ph.D.	Geology of Mt. Dutton—Castro Bluff area.
42*	Doelling, H. H.	U.G.M.S.	Mineral Resources	Mineral appraisal of Garfield County.
43	Everett, G.	U. of Texas	Ph.D.	Geochemistry and petrography of contact metamorphic effects of Iron Springs intrusions.
44	Averitt, P.	U.S.G.S.	Regional Mapping	Geologic Mapping, Cedar City Quadrangle.
45	Robison, R. A.	U. of U.	FR	Coal Mapping—Kaiparowits area.
46	Powers, M. C.	Catawba College	FR	Geomorphology and paleogeography of the Cedar Mesa Formation.
47	Williams, P.	U. of Texas	Ph.D.?	Regional stratigraphy of the Quichapa Formation (Ignimbrite sequence), south-western Utah.
48	Hamblin, W. K.	B.Y.U.	M.S.	Tectonic and volcanic history of the western Grand Canyon, Washington County, Utah—Mohave County, Arizona.
49	Lawrence, J. C.	U. of U.	Ph.D.	Cretaceous stratigraphy of Tropic Shale and Dakota Sandstone—Southern Utah (Escalante and St. George).
50	Grose, L. T.	Colo. S. M.	FR for U.S.B.M.	Reconnaissance and economic study of coal resources and potential in Kolob, Kanab, and Kaiparowits fields.
51	Ziony, J. I.	U.C.L.A.	Ph.D.	Analysis of systematic jointing in part of the Monument Upwarp of southeastern Utah.
52*		U.G.M.S. and U.S. Bur. Mines	Mineral and Water Resources	Chemical content of oil field brines.



INDEX MAP TO SUMMER ACTIVITIES IN UTAH — 1965

UTAH PUBLICATIONS — 1964

This issue of the Quarterly Review is devoted primarily to a compilation of the 1964 publications dealing with the Utah mineral industry. The Utah Geological Survey gratefully acknowledges the assistance of the University of Utah Engineering Library staff, under the direction of Miss Edith Rich, in the compilation of the data contained herein. It has been our goal to make this listing as complete as possible; and if the reader is aware of any other pertinent publications which do not appear in the list below, please call them to our attention.

The 1964 publications are listed first by author alphabetically, and then by subject classification. For this publication the Survey has reduced the subject listing to cover only those areas of economic consideration. However, a complete index of publications, by subject, is on open file in the Office of the Survey, 103 Civil Engineering Building, University of Utah, Salt Lake City, Utah.

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- (1) Geology of the Aspen Grove quadrangle, Utah: U. S. Geol. Survey Geol. Quadrangle Map GQ-239, scale 1:24,000, 9 p. text, 1964.

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- (3) Wasatch fault of the south-central Wasatch Mountains: *in* Utah Geol. Society Guidebook to the Geology of Utah, no. 18, p. 15-30, 1964.

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SUBJECT LISTING**Alteration Areas**

Brooke, J. P.
Proctor, P. D.
Stringham, B.

Basin and Range

Liese, H. C.
Ross, R. J.
Snyder, C. T.

Beaver County

Brooke, J. P.
Connor, J. J.
Mudgett, P. M.

Box Elder County

Doelling, H. H.
Stifel, P. B.

Cache County

Mullens, T. E., 1
Williams, E. J.
Williams, J. S., 1

Carbon County

Cordova, R. M.
Covington, R. E., 2

Davis County

Buss, W. R.

Duchesne County

Calder, L.
Kayser, R. B., 1, 2

Earthquakes

Bryner, C. G.
Lander, J. F.
Marsell, R. E., 2
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Emery County

Brooks, D. B.
Jedwab, J.
Ross, M.
Stokes, W. L., 1, 2

Garfield County

Gardner, F. J.
Thaden, R. E.
Wilson, H. M.

Geology, Economic

Morris, H. T., 1, 2
Proctor, P. D.
Southern Pacific Company
Staatz, M. H.
U. S. Geol. Survey, Utah Geol. Survey,
and Utah Water and Power Board.
Witkind, I. J., 2

Beryllium:

Dannenberg, R. C.
McAnulty, W. N.
Montoya, J. W.
Shawe, D. R., 1, 2

Brines:

Adams, T. C.
Cook, K. L., 2
Glassett, J. M.
Hahl, D. C.
Nylander, A. F.

Clay:

Hope, E. W.
Van Sant, J. N.

Coal:

Landers, W. S.
Robinson, R. A., 4
Schell, E. M.

Copper:

Brett, R.

Gilsonite:

Kilborn, G. R.

Lithium:

McAnulty, W. N.
Shawe, D. R., 2

Natural Gas:

Burchell, P. W.
Horton, G. W., 1, 2
Kunkel, R. P., 1, 2
Praetorius, H. W.

Oil Shale and Bituminous Sandstone:

Cashion, W. B.
Covington, R. E., 2
Curry, H. D.
Henderson, G. V.
Pruitt, R. G.
Smith, J. W.
Sohns, H. W.
Stanfield, K. E.

Pegmatites:

Fowkes, E. J.

Petroleum:

Bass, N. W.
Burchell, P. W.
Gardner, F. J.
Hacker, R. N.
Heylman, E. B., 1, 2
Horton, G. W., 1
Isbell, E. B.
Johnson, C. E.

Kunkel, R. P., 1, 2
McCaslin, J. C.
Praetorius, H. W.
Pruitt, R. G.
Vlissides, S. D.
Wilson, H. M.

Phosphate:

Bradley, J.
King, D. L.
Love, J. D.
Mabie, C. P.
Service, A. L.
Sheldon, R. P.

Potash:

Sweeney, G.

Tellurium:

Everett, F. D.

Uranium:

Cannon, H. L.
Jedwab, J.
Johnson, H. S.
Kerr, P. F.
Koch, G. S.
Lindstrom, P.
Love, J. D.
Ross, R. J.
Thaden, R. E.
Walker, G. W.
Williams, P. L.
Young, R. G.

Vanadium:

Weeks, A. D.

Water Resources:

Arnow, T., 1, 2
Calder, L.
Carpenter, C. H.
Cordova, R. M.
Feth, J. H., 1, 2
Goode, H. D.
Hendricks, E. L.
Irons, W. V.
Love, S. K.
Markland, T. R.
Marine, I. W.
McGuinness, C. L.
Mower, R. W.
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Condie, K. C.
John, E. C.

Geology, Isotope

Weber, J. N., 2, 3
Radiocarbon

Geology, Stratigraphic

Averitt, P., 2
Baker, A. A., 1
Bissell, H. J., 1, 2
Bradley, W. H.
Calder, L.
Clark, D. L.
Cordova, R. M.
Doelling, H. H.
Goode, H. D.
Hale, L. A.
Hansen, S. C.
Henderson, G. V.
Horton, G. W., 1, 2
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Isbell, E. B.
Johnson, H. S.
Kayser, R. B., 2
Kerr, P. F.
Lessentine, R. H.
Morris, H. T., 1, 2
Mullens, T. E., 1
Murany, E. E.
Ohlen, H. R.
Rigby, J. K.
Poole, F. G.
Richmond, G. M.
Roberts, P. K.
Roberts, R. J.
Robison, R. A., 1, 3, 5
Ross, R. J.
Schneider, M. C.
Staat, M. H.
Stifel, P. B.
Stouffer, S. G.
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Walton, P. T.
Williams, J. S., 1, 2
Witkind, I. J., 2
Young, R. G.

Geology, Structural

Averitt, P., 1
Baker, A. A., 1, 2
Bissell, H. J., 3
Buss, W. R.
Bryner, C. G.
Cordova, R. M.
Doelling, H. H.
Goode, H. D.
Hansen, S. C.
Henderson, G. V.
Hintze, L. F., 2
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Marsell, R. E., 3
Morris, H. T., 1, 2, 3
Mullen, T. E., 1
Ohlen, H. R.
Osmond, J. C., 2
Schneider, M. C.
Shawe, D. R., 1
Staat, M. H.
Stifel, P. B.
Stokes, W. L., 4
Stouffer, S. G.
Thaden, R. E.
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Wallace, R. G.
Witkind, I. J., 1, 2

Geomorphology

Marsell, R. E., 1
Stokes, W. L., 3
Williams, E. J.

Geophysics

American Geophysical Union
Cook, K. L., 1, 2
Crosson, R. S.
Hardman, E.
Mabey, D. R.
Mudgett, P. M.
Runcorn, S. K.
Sheldon, R. P.
Spicer, H. C.

Glaciation

Richmond, G. M.
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Grand County

Cannon, H. L.
Clark, D. L.
Horton, G. W., 2
Love, S. K.
Spicer, H. C.
Sweeney, G.
Weeks, A. D.

Iron County

Averitt, P. 1, 2
Hardman, E.

Juab County

Bissell, H. J., 3
Crosson, R. S.
Dannenberg, R. C.
Hope, E. W.
John, E. C.
McAnulty, W. N.
Montoya, J. W.
Morris, 1, 2, 3
Shawe, D. R., 1, 2
Staatz, M. H.

Kaiparowits Basin

Gardner, F. J.
Lessentine, R. H.
McCaslin, J. C.
Robinson, R. A., 4
Wilson, H. M.

Kane County

Stouffer, S. G.
Wilson, M. T.

Maps

American Geophysical Union
Baker, A. A., 1
Hintze, L. F., 1
Hose, R. K., 1, 2, 3, 4
Mabey, D. R.
Mullens, T. E., 2
McGuiness, C. L.
Richmond, G. M.
Staatz, M. H.
Williams, P. L.
Witkind, I. J., 2

Millard County

Crosson, R. S.
Hose, R. K., 1, 2, 3, 4
Mudgett, P. M.

Morgan County

Mullens, T. E., 2

Paleontology

Chamberlain, C. K.
Closs, D.
Cobban, W. A.
Imlay, R. W.
Robinson, R. A., 2, 3
Stokes, W. L., 1, 2
Swain, F. M., 1, 2
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Vaughn, P. P.
White, T. E.

Paradox Basin

Ohlen, H. R.

Rich County

Hansen, S. C.

Salt Lake County

Richmond, G. M.
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San Juan County

Koch, G. S.
Lindstrom, P.
McCaslin, J. C.
Praetorius, H. W.
Thaden, R. E.
Vaughn, P. P.
Vlissides, S. D.
Witkind, I. J., 1
Young, R. G.

Sevier County

Schneider, M. C.

Summit County

Mullens, T. E., 2

Tooele County

Doelling, H. H.
Fowkes, E. J.
Morris, H. T., 2
Staatz, M. H.
Sweeney, G.

Uinta Basin

Aikens, C. M.
Bass, N. W.
Bissell, H. J., 2
Burchell, P. W.
Cashion, W. B.
Covington, R. E., 1, 2
Curry, H. D.
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Love, J. D.
Marsell, R. E., 1
Murany, E. E.
Osmond, J. C., 1, 2
Poole, F. G.
Rigby, J. K.
Roberts, P. K.
Schell, E. M.
Stanfield, K. E.
Swain, F. M., 1, 2
Vlissides, S. D.
Walton, P. T.

Uinta Mountains

Robison, R. A., 1
Runcorn, S. K.

Uintah County

Isbell, F. B.
Johnson, C. E.
Kayser, R. B., 1, 2
King, D. L.
White, T. E.

Utah County

Baker, A. A., 1, 2
Bissell, H. J., 3
Closs, D.
Henderson, G. V.
Markland, T. R.
Marsell, R. E., 3
Morris, H. T., 1, 2
Proctor, P. D.

Wasatch County

Baker, A. A., 1
Calder, L.
Henderson, G. V.

Wasatch Fault

Bissell, H. J., 3
Bryner, C. G.
Buss, W. R.
Marsell, R. E., 2, 3
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Wasatch Mountains

Cook, K. L., 1
Stokes, W. L., 4
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Wasatch Plateau

Swain, F. M., 1
Wallace, R. G.
Weber, J. N., 1, 2, 3

Washington County

Hardman, E.

Weber County

Buss, W. R.

RECENT PUBLICATIONS

Since February the following publications have been printed and are available from the Utah Geological Survey, 103 Civil Engineering Building, University of Utah, Salt Lake City, Utah.

Map 19-Geologic Map Index of Utah by Lehi F. Hintze and Leona Boardman. Compiled by Dr. Lehi F. Hintze, this index, published in 2 sheets, supersedes the outdated Boardman map. Not sold separately, Sheet I contains numbered outlines and references for maps on scales of 1:250,000 to 1:2,500,000. Sheet II contains those maps on scales of 1:600 to 1:250,000. Price \$1.00 per set.

Bulletin 74 - Drilling Records for Oil and Gas in Utah, Jan. 1, 1954 - Dec. 31, 1963, by E. B. Heylman, R. E. Cohenour, and R. B. Kayser. Containing 528 pages, this bulletin supplements Bulletin 50 - Drilling Records for Oil and Gas in Utah, 1955. Price \$5.00 (or a set of two, Bulletin 50 and Bulletin 74, for only \$7.50).

Special Studies 11 - Engineering Implications and Geology, Hall of Justice Excavation, Salt Lake City, Utah, by J. C. Osmond, W. P. Hewitt, and R. Van Horn. 36 pages, 13 illustrations. Price \$1.25.

Water-Resources Bulletin 6 - Evaporation Studies, Great Salt Lake, by D. R. Dickson, E. L. Peck, and C. McCollum, Jr. 36 pages, 14 illustrations. Price \$2.50.

Water Resources Bulletin 7 - Geology and Ground Water Resources of the Jordan Valley, (Salt Lake Metropolitan Area), by I. W. Marine and D. Price. 68 pages, 47 illustrations. Price \$3.00.

IN PRESS

Special Studies 10 - Foundation Characteristics of Sediments, Salt Lake Metropolitan Area, by Richard A. Bauman. This bulletin was compiled from foundation records with the cooperation of Salt Lake's civil engineers and architects. 40 pages, 6 illustrations.

Special Studies 12-Hydrothermal Alteration and Mineralization in the Staats Mine and Blawn Mountain Areas, Central Wah Wah Range, Beaver County, Utah, by James A. Whelan. This study centers around an area that is potentially important for its highly kaolinitized, and alunized mineralization. In the past it has yielded a minor production of fluorte and uranium ores.

LEGISLATION AFFECTING THE MINERAL INDUSTRY

The 1965 biennial legislature of Utah convened January 11, and adjourned March 11, 1965. In the interim it passed the following bills of interest to the mineral industries:

- SB 3 implementing the freeport constitutional amendment approved by Utah voters last fall.
- SB 80 to exempt fuel made from bituminous sand from State Motor Fuel Tax.
- SB 107 to exempt from royalty payment the first 200,000 barrels of oil commercially produced from oil shale on state lands.
- SB 127 to correct a title defect concerning mineral rights and removing necessity of periodic filing to protect rights.
- SB 139 permitting use of oversize trucks on designated highways to assist in development of phosphate industry in eastern Utah.
- SB 144 requiring operator of oil and gas operational units to collect ad valorem taxes from fractional interest holders.
- HB 16 creating a State Industrial Promotion Commission and appropriating \$500,000 for its operation.
- HB 27 authorizing counties to establish and finance resource development committees.
- HB 68 increasing the present 4% rate for the franchise tax to 6% on incomes after December 31, 1964. Originally, the Governor had proposed elimination of the deductibility of federal income taxes, which was considered to be equivalent to a new rate of 7%. This procedure was thought to be rigid, not permitting a lower rate if one were possible. Also it was thought that disallowance without a rate change might be confusing to future legislatures in comparing Utah's rate to rates in other states. The legislature accordingly adopted a rate change policy.
- HB 81 increasing the individual income tax. Old rates were 1% of first \$1,000 of taxable income, progressing by an additional 1% in steps of \$1,000 up to 5% on income above \$4,000. New rates start at 2% on first \$1,000 and proceed to a new high of 6½% on incomes in excess of \$5,000. New rates are effective on income after December 31, 1964 and the Utah State Tax Commission has announced higher withholding rates. A little "Hoover Commission" measure was also passed to review government operations.

RARE METALS

(Continued from page 1)

ide is 0.21% in the Henry Mountains area. The concentration of hafnium in some deposits is high. The report suggests that there might be commercial concentrations of other rare metals in the sixteen known deposits.

The possibilities of finding additional heavy mineral deposits in Utah should be excellent, as Cretaceous sandstones crop out over wide portions of northeastern, eastern, and southern Utah.

EHRHORN TO HEAD MINING ENGINEERS

The Utah Geological Survey joins with mining men everywhere in extending their congratulations to Jack M. Ehrhorn, newly elected President of the Society of Mining Engineers. This new position culminates a long history of active participation in the western mining industry and the Society of Mining Engineers.

The Survey is especially proud of Jack Ehrhorn, for he also serves as Chairman of the Survey's Advisory Board.